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misquoted in the May Number. The word "equally" before liable is omitted. Not noting that word probably accounts for the different solutions."

Professor Philbrick understands the problem to mean that the deer is just as liable to drop dead before running a distance equal to the diagonal of the park as it is to run a greater distance.

This is the meaning we get from the statement of the problem. Now the solutions printed in May No. assume that the deer actually drops dead within the circle whose radius is the diagonal of the square, while the above solution assumes that the probability that deer drops dead within this circle is $\frac{1}{2}$.

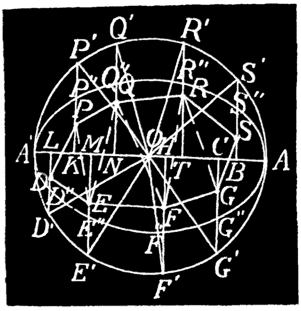
We take "equally liable" to mean that the chance of the deer's dying on running a distance equal to the diagonal of the park is equal to the chance of its not dying on running that distance, and since it must *live* or *die*, the chance for the one or the other is $\frac{1}{2}$. Hence, if the diagonal of the square is the limit of the deer's running before death ensues, the answer is $\frac{1}{2\pi}$; if the diagonal is not the limit, $\frac{1}{4\pi}$ is the answer. ED.]

4. Proposed by Professor G. B. M. ZERR, Principal of High School, Staunton, Virginia.

Four points taken at random in each half, made by the transverse axis, of an ellipse, are joined in such a way by straight lines as to inclose an octagonal surface; find the mean area of this surface.

Solution by the PROPOSER.

Let P, Q, R, S be four points in the semi-ellipse, axis a, b, above the transverse axis AA', D, E, F, G four points in the lower half. Through these draw $P'K$, $Q'N$, $R'T$, $S'B$, $D'L$, $E'M$, $F'H$, $G'C$ perpendicular to AA'. Let $\angle AOP'=\theta$, $\angle AOQ'=\phi$, $\angle AOR'=\psi$, $\angle AOS'=\rho$, $\angle AOD'=\mu$, $\angle AOE'=\nu$, $\angle AOF'=\omega$, $\angle AOG'=\lambda$, $KP=x$, $NQ=w$, $SB=z$, $DL=s$, $RT=y$, $ME=t$, $HF=u$, $CG=v$. Then we have $KP''=b\sin\theta=x'$, $NQ''=b\sin\phi=w'$, $TR''=b\sin\psi=y'$, $BS''=b\sin\rho=z'$, $LD''=b\sin\mu=s'$, $ME''=b\sin\nu=t'$, $HF''=b\sin\omega=u'$, $CG''=b\sin\lambda=v'$. Area of the octagonal surface equals the area of the six triangles $RGS+RGF+FRQ+QFE+EQP+PED$.



$\therefore A=\text{area}=\frac{1}{2}a\{x(\cos\phi-\cos\mu)+w(\cos\psi-\cos\theta)+y(\cos\rho-\cos\phi)+z(\cos\lambda-\cos\psi)+s(\cos\nu-\cos\theta)+t(\cos\omega-\cos\mu)+u(\cos\lambda-\cos\nu)+v(\cos\rho-\cos\omega)\}$.

An element of surface at P is $a\sin\theta\,d\theta dx$; at Q, $a\sin\phi d\phi dw$; at R, $a\sin\psi d\psi dy$; at S, $a\sin\rho d\rho dz$; at D, $a\sin\mu d\mu ds$; at E, $a\sin\nu d\nu dt$; at F, $a\sin\omega d\omega d\omega$; at G, $a\sin\lambda d\lambda dv$.

The limits of θ and μ are 0 and π; of ϕ, 0 and θ; of ψ, 0 and ϕ; of ρ, 0 and ψ; of ν, 0 and μ; of ω, 0 and ν; of λ, 0 and ω. Hence, the reqired average area is,

$$\Delta=\frac{\int_0^{\pi}\int_0^{\theta}\int_0^{\phi}\int_0^{\Phi}\int_0^{\pi}\int_0^{\mu}\int_0^{\nu}\int_0^{\omega}\int_0^{x'}\int_0^{w'}\int_0^{y'}\int_0^{z'}\int_0^{s'}\int_0^{t'}\int_0^{u'}\int_0^{v'} Aa\sin\theta d\theta a\times\sin\phi d\phi a\sin\psi d\psi a\sin\rho d\rho a\sin\mu d\mu a\sin\nu d\nu a\sin\omega d\omega a\sin\lambda d\lambda dx dw dy dz ds dt du dv}{\int_0^{\pi}\int_0^{\theta}\int_0^{\phi}\int_0^{\psi}\int_0^{\pi}\int_0^{\mu}\int_0^{\nu}\int_0^{\omega}\int_0^{x'}\int_0^{w'}\int_0^{y'}\int_0^{z'}\int_0^{s'}\int_0^{t'}\int_0^{u'}\int_0^{v'} a\sin\theta d\theta a\sin\phi d\phi a\times\sin\psi d\psi a\sin\rho d\rho a\sin\mu d\mu a\sin\nu d\nu a\sin\omega d\omega a\sin\lambda d\lambda dx dw dy dz ds dt du dv}$$

$$\varDelta=\frac{2^{14}3^2}{\pi^8b^8}\int_0^\pi\int_0^\theta\int_0^\phi\int_0^\psi\int_0^\pi\int_0^\mu\int_0^\nu\int_0^\omega\int_0^{x'}\int_0^{w'}\int_0^{y'}\int_0^{z'}\int_0^{s'}\int_0^{t'}\int_0^{u'}\int_0^{v'}A\sin\theta\sin\phi$$

$$\times\sin\psi\sin\rho\sin\mu\sin\nu\sin\omega\sin\lambda\,d\theta d\phi d\psi d\rho d\mu d\nu d\omega d\lambda dx dw dy dz ds dt du dv$$

$$=\frac{2^{12}3^2ab}{\pi^8}\int_0^\pi\int_0^\theta\int_0^\phi\int_0^\psi\int_0^\pi\int_0^\mu\int_0^\nu\int_0^\omega[\sin(\theta-\phi)+\sin(\phi-\psi)+\sin(\psi-\rho)$$

$$+\sin(\mu-\nu)+\sin(\nu-\omega)+\sin(\omega-\lambda)+\sin(\lambda-\rho)-\sin(\theta+\mu)]\sin^2\theta\sin^2\phi\sin^2\psi\sin^2\rho$$

$$\times\sin^2\mu\sin^2\nu\sin^2\omega\sin^2\lambda\,d\theta d\phi d\psi d\rho d\mu d\nu dd\omega\lambda,$$

$$=\frac{2^63ab}{\pi^4}\int_0^\pi\int_0^\theta\int_0^\phi\int_\theta^\psi[\sin(\theta-\phi)+\sin(\phi-\psi)+\sin(\psi-\rho)]\sin^2\theta\sin^2\phi\sin^2\psi\sin^2\rho$$

$$d\theta d\phi d\phi d\rho\qquad+\frac{2^{12}3^2ab}{\pi^8}\int_0^\pi\int_0^\theta\int_0^\phi\int_0^\Phi\left\{\left(\frac{\pi^2}{45}-\frac{43264}{496125}\right)\sin\theta+\left(\frac{\pi^2}{45}-\frac{43264}{496125}\right)\sin\rho\right.$$

$$\left.+\left(\frac{\pi^3}{72}-\frac{352\pi}{4725}\right)\cos\rho-\left(\frac{\pi^3}{72}-\frac{352\pi}{4725}\right)\cos\theta\right\}\sin^2\theta\sin^2\phi$$

$$x\sin^2\psi\sin^2\rho d\theta d\phi d\psi d\rho$$

$$=\frac{ab}{\pi}\left\{5-\frac{7667}{240\pi^2}\right\}+\frac{2^{14}ab}{45\pi^7}\left\{\frac{\pi^2}{8}-\frac{352}{525}\right\}\left\{\pi^2-\frac{43264}{11025}\right\}.$$

A partial solution was received from *Professor F. P. Matz.*

5. Proposed by DE VOLSON WOOD. M. A., C. E., Professor of Mechanical Engineering. Stevens Institute of Technology, Hoboken, New Jersey.

An actual case suggested the following:

An equal number of white and black balls of equal size are thrown into a rectangular box, what is the probability that there will be contiguous contact of white balls from one end of the box to the opposite end? As a special example, suppose there are 30 balls in the length of the box, 10 in the width, and 5 (or 10) layers deep.

Solution by Professor P. H. PHILBRICK, M. S., C. E., Lake Charles, Louisiana.

There are 5.10=50 rows and 50×30=1500 balls. The probability will be found by supposing the balls to be drawn singly and at random and the rows formed by the balls as drawn one after another.

The total number of ways of drawing the balls=$|\underline{1500}=a$. To find the number of ways of drawing the balls so that 30 white balls may form a row, 30 white balls may be selected out of 750 in $\dfrac{750.746....721}{1.2.3....30}=b$ ways. The remaining 1470 balls can be drawn in $|\underline{1470}=c$ ways. In order that a given selection of 30 white balls may form a row they must be drawn either before or after the other 49 rows, or between some of them, giving 50 positions.

The number of favorable cases is equal to the product of the last three quantities=$50bc$. Hence the probability is, $\dfrac{50bc}{a}$.

Also solved by *Professor W. H Draughon.*

[Note.—This solution is not entirely satisfactory, since the white balls may be contiguous from one side of the box to the other without being in longitudinal lines. The problem is as if it were required to find the probability of passing from one side of the box to the other by passing through white balls, and white balls only, under the conditions named. The problem is a pretty good one and if any one will